WHAT IS CLAIMED IS:

Sub A2>

1. In a scanning probe microscope and/or nanomachining system (in which scanning probe techniques are a subset of functionality) including a probe and/or tool positioned relative to a sample volume and having relative motion between the probe and the sample volume in the X,Y and Z space and controlled and sensed in any direction with respect to the sample volume or any element thereof and producing data responsive to any element or property of said volume, a method for accurately measuring a parameter of that volume or performing a task related to that volume including the following steps:

providing a first scan by the probe and/or tool of the target volume in X, Y and Z or any element thereof to produce data representative of the volumetric element of target,

storing the data representative of the volume, any parametric representation, and/or simultaneous parametric representation and/or any element of that volume,

providing, optionally, a second operation based on the information previously obtained,

measuring a portion or all of the volume or any other parameter associated with the target volume or making any change to said volume.

2. The method of claim 1 wherein first scan produces volume data by an atomic force measurement.

3. The method of claim 1 wherein first scan produces volume data by a tunneling current measurement.

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4. The method of claim 1 wherein first scan produces volume data by a scanning electron beam probe measurement.

5. The method of claim 1 wherein first scan produces volume data by a scanning ion beam probe measurement.

Sub A4>

6. The method of claim 4 or 5 wherein first scan simultaneously produces electromagnetic data by a scanning particle beam probe measurement.

7. The method of claim 4 or 5 wherein first scan simultaneously produces secondary particle data by a scanning particle beam probe measurement.

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8. The method of claim 1 where the second scan produces volume data by an magnetic force, and/or field and/or gradient measurement.

9. The method of claim 1 wherein first scan produces volume data by an electric field measurement.

10. The method of claim 1 wherein second scan is used to modify the volume in any measurable manner.

11. The method of claim 9 wherein the modification is accomplished by the probe mechanically cutting the volume of the sample.

12. The method of claim 9 wherein the modification is accomplished by applying an electric field between the probe and the volume of the sample.

13. The method of claim 9 wherein the modification is accomplished by applying a particle beam of ions or electrons between the probe and the volume of the sample.

14. In a scanning probe microscope and/or nanomachining system (in which scanning probe techniques are a subset of functionality) including a probe and/or tool positioned relative to a sample volume or topography and having relative motion between the probe and the sample volume or topography in the X,Y and Z space and controlled and sensed in any direction with respect to the sample volume or topography or any element thereof and producing data responsive to any element or property of said volume or topography, a method for accurately measuring a parameter of that volume or topography or performing a task related to that volume or topography including the following steps:

providing a first scan by the probe and/or tool of regions around the target volume or topography in X, Y and Z
or any element thereof to produce data representative of the bounding volumetric or topographic elements of the target(s) volume or topography,

storing the data representative of the bounding volume or topography, any parametric representation, and/or simultaneous parametric representation and/or any element of that volume or topography,

providing, optionally, a second operation based on the information previously obtained,

measuring a portion or all of the volume or topography or any other parameter associated with the target volume or topography or making any change to said volume or topography.

14a The method of claim 14 wherein first scan produces volume or topographic data by an atomic force measurement.

15. The method of claim 14 wherein first scan produces volume or topographic data by a tunneling current measurement.

16. The method of claim 14 wherein first scan produces volume or topographic data by a scanning electron beam probe measurement.

17. The method of claim 14 wherein first scan produces volume or topographic data by a scanning ion beam probe measurement.

18. The method of claim 17 or 18 wherein first scan simultaneously produces electromagnetic data by a scanning particle beam probe measurement.

19. The method of claim 17 or 18 wherein first scan simultaneously produces secondary particle data by a scanning particle beam probe measurement.

20. The method of claim 14 where the second scan produces volume or topographic data by an magnetic force, and/or field and/or gradient measurement.

21. The method of claim 14 wherein first scan produces volume or topographic data by an electric field measurement.

22. The method of claim 14 wherein second scan is used to modify the volume in any measurable manner.

23. The method of claim 21 wherein the modification is accomplished by the probe mechanically cutting the volume of the sample.

24. The method of claim 21 wherein the modification is accomplished by applying an electric field between the probe and the volume of the sample.

25. The method of claim 21 wherein the modification is accomplished by applying a particle beam of ions or electrons between the probe and the volume of the sample.

26. In a scanning probe microscope and/or nanomachining system (in which scanning probe techniques are a subset of functionality) including a probe and/or tool positioned relative to a sample volume or topography and having relative motion between the probe and the sample volume or topography in the X,Y and Z space and controlled and sensed in any direction with respect to the sample volume or topography or any element thereof and producing data responsive to any element or property of said volume or topography, a method for accurately measuring a parameter of that volume or topography or performing a task related to that volume or topography including the following steps:

providing a first location by the probe and/or tool of regions around/on or within the target volume or topography in X, Y and Z
or any element thereof to locate the volumetric or topographic elements of a starting reference point or points the target(s) volume or topography,

without storing the data representative of the bounding volume or topography, any parametric representation, and/or simultaneous parametric representation

and/or any element of that volume or topography,

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measuring a portion or all of the volume or topography or any other parameter associated with the target volume or topography or making any change to said volume or topography.

27. The method of claim 26 wherein first scan produces volume data by an atomic force measurement.

28. The method of claim 26 wherein first scan produces volume data by a tunneling current measurement.

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29. The method of claim 26 wherein first scan produces volume data by a scanning electron beam probe measurement.

30. The method of claim 26 wherein first scan produces volume data by a scanning ion beam probe measurement.

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31. The method of claim 29 or 30 wherein first scan simultaneously produces electromagnetic data by a scanning particle beam probe measurement.

32. The method of claim 29 or 30 wherein first scan simultaneously produces secondary particle data by a scanning particle beam probe measurement.

33. The method of claim 26 where the second scan produces volume data by an magnetic force, and/or field and/or gradient measurement.

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34. The method of claim 26 wherein first scan produces volume data by an electric field measurement.

35. The method of claim 26 wherein second scan is used to modify the volume in any measurable manner.

36. The method of claim 34 wherein the modification is accomplished by the probe mechanically cutting the volume of the sample.

37. The method of claim 34 wherein the modification is accomplished by applying an electric field between the probe and the volume of the sample.

38. The method of claim 34 wherein the modification is accomplished by applying a particle beam of ions or electrons between the probe and the volume of the sample.

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39. An illumination system for opague or optically limited or blocked stage in which illumination is introduced along one or more edges of the sample and is arranged so reflecting elements cause the illumination to be propagated across the sample.

40. An illumination system for opague or optically limited or blocked stage in which illumination is introduced along one or more edges of the sample and is arranged so reflecting elements cause the illumination to be propagated across the sample as in 39 in which the intensity of the illumination introduced into the sample is a function of the

position of the stage with respect to the optical observing means.

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41. An illumination system for opague or optically limited or blocked stage in which illumination is introduced along one or more sides of the sample, striking the sample at a glancing angle just under the optical observing means.

42. An illumination system for opague or optically limited or blocked stage in which illumination is introduced along one or more sides of the sample, striking the sample at a glancing angle just under the optical observing means as in 41 in which the source means is fixed to always point at the glancing area below a fixed optical observing means.

43. An illumination system for opague or optically limited or blocked stage in which illumination is introduced along one or more sides of the sample, striking the sample at a glancing angle just under the optical observing means as in 41 in which the source means is moved to always point at the glancing area below a movable optical observing means

44. A nanomachining system as describe herein in which the tip or tool is clamped by mechanical, magnetic, or electrostaic means prior to begining the nanomachining material modification process.

45. A nanomachining system as described herein in which the tip or tool is stopped from any SPM induced vibration and is moved a known or estimated distance to contact or nearly contact the target volume.

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46. A nanomachining system as described herein in which the tip or tool is stopped from any SPM induced vibration and is moved until a measureable change in any related sensing system indicates that the tip ot tool is in contact with the target volume.

47. A nanomachining system as described herein in which the tip or tool is not stopped from any SPM induced vibration but is restricted in its normal motion (associated with measurement) so as to follow the loci of a target nanomachining step to nanomachine a particular featuee(s) in the target volume.

48. A nanomachining system as described herein in which the tip or tool is not stopped from any SPM induced vibration but is restricted in its normal motion (associated with measurement) so as to follow the loci of a target nanomachining step to nanomachine a particular featuee(s) in the target volume and the means for monitoring the tip ot tool for measurement is used to determine when the tip or tool is no longer cutting the target volume.

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49. A nanomachining system as described herein in which the tip or tool is not stopped from any SPM induced vibration but is restricted in its normal motion (associated with measurement) so as to follow the loci of a target nanomachining step to nanomachine a particular featuee(s) in the target volume and the means for monitoring the tip ot tool for measurement is used to determine when the tip or tool is no longer cutting the target volume.